



QUALCOMM Incorporated

5775 Morehouse Drive  
San Diego, CA 92121-1714

[www.qualcomm.com](http://www.qualcomm.com)

Via Email and Mail

February 23, 2018

Mr. Thomas Goode, ATIS General Counsel  
ATIS  
1200 G. Street, NW  
Suite 500  
Washington, DC 20005  
Email: [patents@atis.org](mailto:patents@atis.org)

RE: Updated and corrected commitment to previous disclosures made by Qualcomm Incorporated on June 25, 2015, October 3, 2016 and February 21, 2018

Dear Mr. Goode:

Our apologies for using the wrong form for our ATIS disclosures dated June 25, 2015, October 3, 2016 and February 21, 2018. Qualcomm hereby agrees that in addition to the promises and representations made in association with these three earlier disclosure forms, Qualcomm commits to the following statement for each of those earlier disclosures.

The Party submitting this Statement agrees that the patent holder (or party authorized to make assurances on its behalf) will, in any documents transferring ownership of patents subject to the assurance, include provisions sufficient to ensure that the commitments in the assurance are binding on the transferee, and that the transferee will similarly include appropriate provisions in the event of future transfers with the goal of binding each successor-in-interest. This assurance is intended to be binding on successors-in-interest regardless of whether such provisions are included in the relevant transfer documents.

Executed this 23 day of February, 2018, for Qualcomm Incorporated, by:

Michael Atlass, Sr. Director and Legal Counsel  
Qualcomm Incorporated.

Please confirm receipt of this letter at your earliest convenience via email to my attention at [ip.disclosure@qualcomm.com](mailto:ip.disclosure@qualcomm.com). If you have any questions or concerns, please call 858-587-1121.

**Qualcomm**

Michael Atlass  
Sr. Director, Legal Counsel  
California Registered In-House Counsel

MA/go



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Via Email and Mail

February 21, 2018

Mr. Thomas Goode  
ATIS General Counsel  
ATIS  
1200 G. Street, NW  
Suite 500  
Washington, DC 20005  
Email: [patents@atis.org](mailto:patents@atis.org)

RE: Patent Holder Statement on behalf of QUALCOMM Incorporated for M.2012\_Revision\_3

Dear Mr. Goode:

Please find attached Qualcomm Incorporated's Patent Holder Statement for M.2012\_Revision\_3.

Please confirm receipt of this Statement at your earliest convenience via email to my attention at [ip.disclosure@qualcomm.com](mailto:ip.disclosure@qualcomm.com). If you have any questions or concerns, please contact me directly at 858-587-1121. Thank you.

Sincerely,

A handwritten signature in blue ink, appearing to read "TR Rouse", with a long horizontal flourish extending to the right.

Thomas R. Rouse  
VP & Legal Counsel  
Standards Policy & Compliance  
Qualcomm Incorporated

TR/go

## ALLIANCE FOR TELECOMMUNICATIONS INDUSTRY SOLUTIONS

### PATENT HOLDER STATEMENT

Please return via mail, email (scanned with signature), or fax to:

General Counsel

ATIS

1200 G Street, N.W., Suite 500

Washington, D.C. 20005 USA

Fax: +1 (888) 874-0973

Email: [patents@atis.org](mailto:patents@atis.org)

This form may be used consistent with ATIS' Intellectual Property Rights Policy, which may be found in ATIS Operating Procedures (Version 5.1), Section 10.4 by the holder of a patented invention that may be required for adopting, complying with or otherwise utilizing an ATIS-developed American National Standard or other ATIS deliverable.

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The use of this form, or its submission to ATIS, is not and shall not be construed as the grant of a license in connection with any patented inventions identified. Nor shall this form or its use create or imply any obligation by the holder of a patented invention to conduct a patent search. To the extent that a license may be sought from the holder of the patented invention identified in this form, the discussion and negotiation of all license terms shall occur directly between the holder of the patented invention and each prospective licensee outside the deliberations of ATIS and its Forums and Committees.

No discussion or negotiation of license terms is permitted in any Forum or Committee. For further information regarding the licensing of any patented inventions identified in this Statement, please contact the person identified in Section B.

#### A. PARTY SUBMITTING THE STATEMENT

Legal Name (e.g. XYZ Corp.):

QUALCOMM Incorporated

#### B. CONTACT FOR LICENSING INFORMATION

|               |  |        |   |
|---------------|--|--------|---|
| Contact Name: | Thomas R. Rouse  | Title: | VP & Legal Counsel, Standards Policy & Compliance |
| Department:   | QTL  |        |   |
| Telephone:    | 858-587-1121   | Fax:   | 858-651-0933                                      |
| Email:        | <a href="mailto:ip.disclosure@qualcomm.com">ip.disclosure@qualcomm.com</a> |        |   |

### C. ATIS-DEVELOPED AMERICAN NATIONAL STANDARD OR OTHER ATIS DELIVERABLE

Please complete a separate Patent Holder Statement for each standard/deliverable.

|  |                   |
|--|-------------------|
| ATIS Forum/Committee:                        | WTSC              |
| ATIS Document Number:                        | See attached list |
| Title:                                       | M.2012_Revision_3 |
| Other tracking identifiers*, if appropriate: |                   |

\*Note: If the standard/deliverable information is not available, please provide available tracking identifiers (e.g., Committee and Issue number, working text number, contribution number).

### D. LICENSING ASSURANCE

In accordance with Section 10.4 of the ATIS Operating Procedures, the Party submitting this Statement hereby declares the following (*check box 1, 2a, 2b or 2c and either box 3a or 3b*):

- ☐ 1. The Party submitting this Statement does not hold or does not currently intend holding any invention the use of which would be required for compliance with the ATIS-developed American National Standard or other ATIS deliverable identified in Section C.
2. The Party submitting this Statement may hold a patent covering an invention the use of which may be required for compliance with the ATIS-developed American National Standard or other ATIS deliverable identified in Section C, and with respect to claim(s) of such patent(s), as may be specified more particularly in Section E, that are required for compliance with that ATIS-developed American National Standard or other ATIS deliverable (*check only one box*):
- ☐ a. An irrevocable license will be made available under reasonable terms and conditions that are demonstrably free of any unfair discrimination, without compensation, to applicants desiring to utilize the license for the purpose of implementing the American National Standard or other ATIS deliverable;
- Mark here ☐ if the Party submitting this Statement reserves the right to obtain compensation from applicants who are only willing to license, for compensation, their claim(s) of patents covering an invention, the use of which is required for compliance with the ATIS-developed American National Standard or other ATIS deliverable identified in Section C, on reasonable terms and conditions that are demonstrably free of any unfair discrimination.
- or
- ☒ b. An irrevocable license will be made available under reasonable terms and conditions that are demonstrably free of any unfair discrimination, with compensation, to applicants desiring to utilize the license for the purpose of implementing the American National Standard or other ATIS deliverable;
- Mark here ☒ if such licensing assurance is subject to applicant reciprocity.
- or
- ☐ c. Is unwilling or unable to grant licenses according to the provisions of either 2a or 2b.

3. If the Party submitting this Statement has checked box 2a or 2b, please indicate whether (*check a or b below*):

- ☐ a. The license assurance is provided for any claim(s) of any patent(s) owned or controlled by the Party submitting this Statement, and which such Party has a right to license, covering an invention the use of which is required for compliance with the American National Standard or other ATIS deliverable identified in Section C, including the claim(s) of the patent(s) identified in Section E, if any; or
- ☒ b. The license assurance is provided only for the claim(s) of the patent(s) identified in Section E covering an invention the use of which is required for compliance with the American National Standard or other ATIS deliverable identified in Section C.


#### E. IDENTIFICATION OF PATENTS

(Completion of the following information is optional if D3a is selected. If D3b is selected, please provide the information indicated below for each patent or application. Attach additional sheets as necessary.)

| Patent No. or<br>Application No. (if<br>pending) | Country | Status<br>(Granted/<br>Pending) | Title | Relevance* |
|--|---------|---------------------------------|-------|------------|
| See attached list                                |         |                                 |       |            |
|  |         |                                 |       |            |
|  |         |                                 |       |            |
|  |         |                                 |       |            |
|  |         |                                 |       |            |

\* Note: A Party may, at its discretion, provide further information or explanation in respect of the invention's relevance to the American National Standard or other ATIS Deliverable identified in Section C.

**F. SIGNATURE**

|   |  |
|---|--|
| Name of Authorized Person<br>(type or print legibly): | Thomas R. Rouse  |
| Signature of Authorized Person:                       |  |
| Title:  | VP & Legal Counsel, Standards Policy & Compliance                                  |
| Date:   | February 21, 2018  |

For more information regarding ATIS' patent policy, please see Section 10.4 of the ATIS Operating Procedures (Version 5.1), which is available online at [www.atis.org/op.pdf](http://www.atis.org/op.pdf).

Please return via mail, email (scanned with signature), or fax to:

General Counsel

ATIS

1200 G Street, N.W., Suite 500

Washington, D.C. 20005 USA

Fax: +1 (888) 874-0973

Email: [patents@atis.org](mailto:patents@atis.org)

Qualcomm Incorporated  
February 21, 2018

| Patent No. or Application No. (if pending) | Country       | Status  | Title  | Specification   |
|--|---------------|---------|--|---|
| 9,118,387                                  | United States | Granted | PILOT REFERENCE TRANSMISSION FOR A WIRELESS COMMUNICATION SYSTEM   | ATIS.3GPP.36.300V8120-2010;<br>ATIS.3GPP.36.302V821-2014;<br>ATIS.3GPP.36.401V880-2012    |
| 9,124,344                                  | United States | Granted | Pilot reference transmission for a wireless communication system   | ATIS.3GPP.36.300V8120-2010;<br>ATIS.3GPP.36.302V821-2014;<br>ATIS.3GPP.36.401V880-2012    |
| 7,289,473                                  | United States | Granted | Pilot Reference Transmission for a Wireless Communication System   | ATIS.3GPP.36.300V8120-2010;<br>ATIS.3GPP.36.302V821-2014;<br>ATIS.3GPP.36.401V880-2012    |
| 7,190,687                                  | United States | Granted | Method and apparatus for requesting point-to-point protocol (PPP) instances from a packet data services network            | ATIS.3GPP.24.301V8100-2012  |
| 7,773,547                                  | United States | Granted | Method and apparatus for requesting point-to-point protocol (PPP) instances from a packet data services network            | ATIS.3GPP.24.301V8100-2012  |
| 6,535,739                                  | United States | Granted | METHOD OF HANDOFF WITHIN A TELECOMMUNICATIONS SYSTEM CONTAINING DIGITAL BASE STATIONS WITH DIFFERENT SPECTRAL CAPABILITIES | ATIS.3GPP.25.214V8130-2014;<br>ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V10120-2015 |
| 7,373,149                                  | United States | Granted | Method of handoff within a telecommunications system containing digital base stations with different spectral capabilities | ATIS.3GPP.25.214V8130-2014;<br>ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V10120-2015 |
| 6,853,843                                  | United States | Granted | Method of handoff within a telecommunications system containing digital base stations with different spectral capabilities | ATIS.3GPP.25.214V8130-2014;<br>ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V10120-2015 |
| 7,151,933                                  | United States | Granted | Method of handoff within a telecommunications system containing digital base stations with different spectral capabilities | ATIS.3GPP.25.214V8130-2014;<br>ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V10120-2015 |
| 6,996,069                                  | United States | Granted | Method and apparatus for controlling transmit power of multiple channels in a CDMA communication system                    | ATIS.3GPP.25.214V11110-2016   |
| 7,936,690                                  | United States | Granted | Method and apparatus for controlling transmit power of multiple channels in a CDMA communication system                    | ATIS.3GPP.25.214V11110-2016   |
| 7,813,441                                  | United States | Granted | Multiplexing of real time services and non-real time services for OFDM systems   | ATIS.3GPP.36.212V880-2010   |
| 8,194,776                                  | United States | Granted | Multiplexing of real time services and non-real time services for OFDM systems   | ATIS.3GPP.36.212V880-2010   |
| 6,952,454                                  | United States | Granted | Multiplexing of real time services and non-real time services for OFDM systems   | ATIS.3GPP.36.212V880-2010   |

Qualcomm Incorporated  
February 21, 2018

| Patent No. or Application No. (if pending) | Country       | Status      | Title  | Specification   |
|--|---------------|-------------|--|---|
| 7,664,193                                  | United States | Granted     | Multiplexing of real time services and non-real time services for OFDM systems                             | ATIS.3GPP.36.212V880-2010                                 |
| 7,751,492                                  | United States | Granted     | Multiplexing of real time services and non-real time services for OFDM systems                             | ATIS.3GPP.36.212V880-2010                                 |
| 14/296,081                                 | United States | Application | Multiplexing of real time services and non-real time services for OFDM systems                             | ATIS.3GPP.36.212V880-2010                                 |
| 7,127,654                                  | United States | Granted     | Method and an apparatus for a quick retransmission of signals in a communication system                    | ATIS.3GPP.36.300V8120-2010                                |
| 6,694,469                                  | United States | Granted     | METHOD AND AN APPARATUS FOR A QUICK RETRANSMISSION OF SIGNALS IN A COMMUNICATION SYSTEM                    | ATIS.3GPP.36.300V8120-2010                                |
| 7,613,978                                  | United States | Granted     | Method and an apparatus for a quick retransmission of signals in a communication system                    | ATIS.3GPP.36.300V8120-2010                                |
| 7,088,701                                  | United States | Granted     | METHOD AND APPARATUS FOR ADAPTIVE TRANSMISSION CONTROL IN A HIGH DATA RATE COMMUNICATION SYSTEM            | ATIS.3GPP.36.300V8120-2010;<br>ATIS.3GPP.36.322V880-2012  |
| 8,363,576                                  | United States | Granted     | Method and apparatus for multiplexing high-speed packet data transmission with voice/data transmission     | ATIS.3GPP.36.211V890-2010                                 |
| 6,775,254                                  | United States | Granted     | Method and Apparatus for Multiplexing High-Speed Packet Data Transmission with Voice/Data Transmission     | ATIS.3GPP.36.211V890-2010                                 |
| 8,139,545                                  | United States | Granted     | Method and apparatus for forwarding messages among multiple radio networks                                 | ATIS.3GPP.23.272V9150-2014                                |
| 6,961,329                                  | United States | Granted     | Method and apparatus for forwarding messages among multiple radio networks                                 | ATIS.3GPP.23.272V9150-2014                                |
| 7,042,869                                  | United States | Granted     | Method and Apparatus for Gated ACK/NAK Channel in a Communication System                                   | ATIS.3GPP.36.213V880-2010                                 |
| 7,068,683                                  | United States | Granted     | Method and apparatus for high rate packet data and low delay data transmissions                            | ATIS.3GPP.36.213V1240-2015                                |
| 9,426,821                                  | United States | Granted     | Method and apparatus for high rate packet data and low delay data transmissions                            | ATIS.3GPP.36.213V1240-2015                                |
| 9,107,109                                  | United States | Granted     | Method and apparatus for determining a data rate in a high rate packet data wireless communications system | ATIS.3GPP.36.101V8260-2016;<br>ATIS.3GPP.36.331V8210-2016 |
| 6,973,098                                  | United States | Granted     | Method and Apparatus for Determining a Data Rate in a High Rate Packet Data Wireless Communications System | ATIS.3GPP.36.101V8260-2016;<br>ATIS.3GPP.36.331V8210-2016 |
| 7,860,061                                  | United States | Granted     | Method and apparatus for handoff of a wireless packet data services connection                             | ATIS.3GPP.24.008V8190-2014;<br>ATIS.3GPP.24.301V8100-2012 |
| 7,561,555                                  | United States | Granted     | Method and apparatus for handoff of a wireless packet data services connection                             | ATIS.3GPP.24.008V8190-2014;<br>ATIS.3GPP.24.301V8100-2012 |
| 7,079,511                                  | United States | Granted     | Method and Apparatus for Handoff of a Wireless Packet Data Services Connection                             | ATIS.3GPP.24.008V8190-2014;<br>ATIS.3GPP.24.301V8100-2012 |
| 7,411,929                                  | United States | Granted     | Method and Apparatus for Utilizing Channel State Information in a Wireless Communication System            | ATIS.3GPP.36.212V1080-2015                                |



Qualcomm Incorporated  
February 21, 2018

| Patent No. or Application No. (if pending) | Country       | Status  | Title   | Specification  |
|--|---------------|---------|---|--|
| 7,949,060                                  | United States | Granted | Method and apparatus for utilizing channel state information in a wireless communication system | ATIS.3GPP.36.212V1080-2015                                 |
| 6,771,706                                  | United States | Granted | Method and Apparatus for Utilizing Channel State Information in a Wireless Communication System | ATIS.3GPP.36.212V1080-2015                                 |
| 7,590,182                                  | United States | Granted | Method and apparatus for utilizing channel state information in a wireless communication system | ATIS.3GPP.36.212V1080-2015                                 |
| 7,349,425                                  | United States | Granted | Method and Apparatus for Overhead Messaging in a Wireless Communication System                  | ATIS.3GPP.36.331V9180-2016                                 |
| 6,731,936                                  | United States | Granted | Method and System for a Handoff in a Broadcast Communication System                             | ATIS.3GPP.36.300V11120-2015;<br>ATIS.3GPP.36.304V1160-2015 |
| 7,937,086                                  | United States | Granted | Method and system for a handoff in a broadcast communication system                             | ATIS.3GPP.36.300V11120-2015;<br>ATIS.3GPP.36.304V1160-2015 |
| 7,254,394                                  | United States | Granted | Method and System for a Handoff in a Broadcast Communication System                             | ATIS.3GPP.36.300V11120-2015;<br>ATIS.3GPP.36.304V1160-2015 |
| 8,644,170                                  | United States | Granted | Rate selection for an OFDM system   | ATIS.3GPP.36.212V880-2010                                  |
| 7,012,883                                  | United States | Granted | Rate Selection for An OFDM System   | ATIS.3GPP.36.212V880-2010                                  |
| 8,089,940                                  | United States | Granted | Method and system for efficient and reliable data packet transmission                           | ATIS.3GPP.36.321V8120-2014                                 |
| 8,711,763                                  | United States | Granted | Random access for wireless multiple-access communication systems                                | ATIS.3GPP.25.331V11120-2016                                |
| 8,169,944                                  | United States | Granted | Random access for wireless multiple-access communication systems                                | ATIS.3GPP.25.331V11120-2016                                |
| 7,042,857                                  | United States | Granted | Uplink Pilot and Signaling Transmission in Wireless Communication Systems                       | ATIS.3GPP.36.331V8210-2016                                 |
| 8,724,555                                  | United States | Granted | Uplink pilot and signaling transmission in wireless communication systems                       | ATIS.3GPP.36.331V8210-2016                                 |
| 6,928,062                                  | United States | Granted | Uplink Pilot and Signaling Transmission in Wireless Communication Systems                       | ATIS.3GPP.36.331V8210-2016                                 |
| 9,155,106                                  | United States | Granted | Uplink pilot and signaling transmission in wireless communication systems                       | ATIS.3GPP.36.331V8210-2016                                 |
| 7,146,130                                  | United States | Granted | Wireless Local Access Network System Detection and Selection                                    | ATIS.3GPP.25.331V1240-2016                                 |
| 8,064,927                                  | United States | Granted | Wireless local access network system detection and selection                                    | ATIS.3GPP.25.331V1240-2016                                 |
| 7,778,593                                  | United States | Granted | Wireless local access network system detection and selection                                    | ATIS.3GPP.25.331V1240-2016                                 |
| 7,280,467                                  | United States | Granted | Pilot transmission schemes for wireless multi-carrier communication systems                     | ATIS.3GPP.36.300V8120-2010                                 |

| Patent No. or Application No. (if pending) | Country       | Status  | Title   | Specification   |
|--|---------------|---------|---|---|
| 7,062,272                                  | United States | Granted | Method and Apparatus to Track Count of Broadcast Content Recipients in a Wireless Telephone Network | ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.300V11120-2015;<br>ATIS.3GPP.36.300V1240-2015  |
| 7,813,732                                  | United States | Granted | Method and apparatus to track count of broadcast content recipients in a wireless telephone network | ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.300V11120-2015;<br>ATIS.3GPP.36.300V1240-2015  |
| 7,251,487                                  | United States | Granted | Method and Apparatus to Track Count of Broadcast Content Recipients in a Wireless Telephone Network | ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.300V11120-2015;<br>ATIS.3GPP.36.300V1240-2015  |
| 7,409,212                                  | United States | Granted | Method and Apparatus to Track Count of Broadcast Content Recipients in a Wireless Telephone Network | ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.300V11120-2015;<br>ATIS.3GPP.36.300V1240-2015  |
| 7,280,562                                  | United States | Granted | Variable Packet Lengths for High Packet Data Rate Communications                                    | ATIS.3GPP.36.331V8210-2016  |
| 8,576,894                                  | United States | Granted | Systems and methods for using code space in spread-spectrum communications                          | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.211V1070-2013  |
| 8,705,588                                  | United States | Granted | Systems and methods for using code space in spread-spectrum communications                          | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.211V1070-2013  |
| 7,668,125                                  | United States | Granted | Incremental redundancy transmission for multiple parallel channels in a MIMO communication system   | ATIS.3GPP.36.212V880-2010;<br>ATIS.3GPP.36.213V880-2010;<br>ATIS.3GPP.36.300V8120-2010;<br>ATIS.3GPP.36.321V8120-2014<br>ATIS.3GPP.36.300V8120-2010 |
| 8,873,365                                  | United States | Granted | Transmit diversity processing for a multi-antenna communication system                              | ATIS.3GPP.36.300V8120-2010  |
| 8,934,329                                  | United States | Granted | Transmit diversity processing for a multi-antenna communication system                              | ATIS.3GPP.36.300V8120-2010  |
| 7,002,900                                  | United States | Granted | Transmit Diversity Processing for a Multi-Antenna Communication System                              | ATIS.3GPP.36.300V8120-2010  |
| 8,060,129                                  | United States | Granted | Peer-to-peer communications   | ATIS.3GPP.36.212V1230-2015;<br>ATIS.3GPP.36.300V1240-2015   |
| 7,539,507                                  | United States | Granted | Peer-to-peer communications   | ATIS.3GPP.36.212V1230-2015;<br>ATIS.3GPP.36.300V1240-2015   |

| Patent No. or Application No. (if pending) | Country       | Status      | Title  | Specification  |
|--|---------------|-------------|--|--|
| 8,023,474                                  | United States | Granted     | Systems and methods for communicating control data using multiple slot formats   | ATIS.3GPP.25.211V1210-2016;<br>ATIS.3GPP.36.213V880-2010                               |
| 7,474,643                                  | United States | Granted     | Systems and Methods for Communicating Control data Using Multiple Slot Formats   | ATIS.3GPP.25.211V1210-2016;<br>ATIS.3GPP.36.213V880-2010                               |
| 8,204,149                                  | United States | Granted     | Spatial spreading in a multi-antenna communication system  | ATIS.3GPP.36.211V890-2010  |
| 8,903,016                                  | United States | Granted     | Spatial spreading in a multi-antenna communication system  | ATIS.3GPP.36.211V890-2010  |
| 9,787,375                                  | United States | Granted     | Spatial spreading in a multi-antenna communication system  | ATIS.3GPP.36.211V890-2010  |
| 15/728,407                                 | United States | Application | SPATIAL SPREADING IN A MULTI-ANTENNA COMMUNICATION SYSTEM  | ATIS.3GPP.36.211V890-2010  |
| 8,582,621                                  | United States | Granted     | Synchronized broadcast/multicast communication   | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.331V9180-2016                               |
| 8,619,835                                  | United States | Granted     | Synchronized broadcast/multicast communication   | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.331V9180-2016                               |
| 8,363,697                                  | United States | Granted     | Synchronized broadcast/multicast communication   | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.331V9180-2016                               |
| 8,737,538                                  | United States | Granted     | Synchronized broadcast/multicast communication   | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.331V9180-2016                               |
| 8,638,765                                  | United States | Granted     | System and method for distributing wireless network access parameters  | ATIS.3GPP.36.300V1350-2017   |
| 7,653,037                                  | United States | Granted     | System and method for distributing wireless network access parameters  | ATIS.3GPP.36.300V1350-2017   |
| 8,995,547                                  | United States | Granted     | Systems and methods for reducing uplink resources to provide channel performance feedback for adjustment of downlink MIMO channel data rates | ATIS.3GPP.36.211V890-2010  |
| 7,706,324                                  | United States | Granted     | On-demand reverse-link pilot transmission  | ATIS.3GPP.36.212V1080-2015;<br>ATIS.3GPP.36.213V10120-2015                             |
| 8,259,669                                  | United States | Granted     | On-demand reverse-link pilot transmission  | ATIS.3GPP.36.212V1080-2015;<br>ATIS.3GPP.36.213V10120-2015                             |
| 8,000,221                                  | United States | Granted     | Adaptive pilot insertion for a MIMO-OFDM system  | ATIS.3GPP.36.211V1070-2013;<br>ATIS.3GPP.36.212V1080-2015                              |
| 8,547,820                                  | United States | Granted     | Adaptive pilot insertion for a MIMO-OFDM system  | ATIS.3GPP.36.211V1070-2013;<br>ATIS.3GPP.36.212V1080-2015                              |
| 9,137,822                                  | United States | Granted     | Efficient signaling over access channel  | ATIS.3GPP.36.213V880-2010;<br>ATIS.3GPP.36.214V870-2010;<br>ATIS.3GPP.36.331V8210-2016 |
| 15/499,705                                 | United States | Application | EFFICIENT SIGNALING OVER ACCESS CHANNEL  | ATIS.3GPP.36.213V880-2010;<br>ATIS.3GPP.36.214V870-2010;<br>ATIS.3GPP.36.331V8210-2016 |

| Patent No. or Application No. (if pending) | Country       | Status      | Title   | Specification   |
|--|---------------|-------------|---|---|
| 14/821,664                                 | United States | Application | Efficient signaling over access channel   | ATIS.3GPP.36.213V880-2010;<br>ATIS.3GPP.36.214V870-2010;<br>ATIS.3GPP.36.331V8210-2016  |
| 15/846,510                                 | United States | Application | EFFICIENT SIGNALING OVER ACCESS CHANNEL   | ATIS.3GPP.36.213V880-2010;<br>ATIS.3GPP.36.214V870-2010;<br>ATIS.3GPP.36.331V8210-2016  |
| 8,693,383                                  | United States | Granted     | Method and apparatus for high rate data transmission in wireless communication                              | ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V1240-2015   |
| 9,350,514                                  | United States | Granted     | SENDING FULL CHANNEL QUALITY INDICATION REPORTS ON TDM CHANNEL IN WIRELESS COMMUNICATION                    | ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V1240-2015   |
| 9,319,201                                  | United States | Granted     | REVERSE LINK PILOT WITH SELECTIVE GATING IN WIRELESS COMMUNICATION  | ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V1240-2015   |
| 9,407,418                                  | United States | Granted     | CHANNELIZING PACKET ACKNOWLEDGMENTS FOR MULTIPLE DATA CHANNELS IN WIRELESS COMMUNICATION                    | ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V1240-2015   |
| 15/160,879                                 | United States | Allowed     | SENDING FULL CHANNEL QUALITY INDICATION REPORTS ON TDM CHANNEL IN WIRELESS COMMUNICATION                    | ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V1240-2015   |
| 8,942,713                                  | United States | Granted     | Method and apparatus for allocating resources in a multicast/broadcast communications system                | ATIS.3GPP.36.304V1330-2017;<br>ATIS.3GPP.36.331V1330-2017   |
| 8,095,141                                  | United States | Granted     | Use of supplemental assignments   | ATIS.3GPP.36.321V8120-2014  |
| 8,706,144                                  | United States | Granted     | 1x and 1xEV-DO hybrid call setup  | ATIS.3GPP.36.304V9110-2014  |
| 9,474,044                                  | United States | Granted     | 1x and 1xEV-DO hybrid call setup  | ATIS.3GPP.36.304V9110-2014  |
| 7,961,700                                  | United States | Granted     | Multi-carrier operation in data transmission systems  | ATIS.3GPP.25.211V870-2012;<br>ATIS.3GPP.25.214V8130-2014;<br>ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.25.331V8250-2016;<br>ATIS.3GPP.36.212V1080-2015;<br>ATIS.3GPP.36.300V10120-2015 |
| 8,169,980                                  | United States | Granted     | Methods and apparatuses for interworking  | ATIS.3GPP.36.300V11120-2015;<br>ATIS.3GPP.36.331V1130-2013  |
| 9,408,220                                  | United States | Granted     | Channel quality reporting for adaptive sectorization  | ATIS.3GPP.36.214V870-2010;<br>ATIS.3GPP.36.331V8210-2016  |
| 9,307,544                                  | United States | Granted     | Channel quality reporting for adaptive sectorization  | ATIS.3GPP.36.214V870-2010;<br>ATIS.3GPP.36.331V8210-2016  |
| 8,798,666                                  | United States | Granted     | Methods and apparatus for mobile terminal-based radio resource management and wireless network optimization | ATIS.3GPP.36.331V8210-2016  |
| 9,839,005                                  | United States | Granted     | Methods and apparatus for mobile terminal-based radio resource management and wireless network optimization | ATIS.3GPP.36.331V8210-2016  |

| Patent No. or Application No. (if pending) | Country       | Status      | Title   | Specification   |
|--|---------------|-------------|---|---|
| 7,965,789                                  | United States | Granted     | Reverse link power control for an OFDMA system  | ATIS.3GPP.36.213V10120-2015                               |
| 8,520,745                                  | United States | Granted     | Reverse link power control for an OFDMA system  | ATIS.3GPP.36.213V10120-2015                               |
| 8,718,181                                  | United States | Granted     | Reverse link power control for an OFDMA system  | ATIS.3GPP.36.213V10120-2015                               |
| 8,639,190                                  | United States | Granted     | Precoding for segment sensitive scheduling in wireless communication systems  | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.212V880-2010   |
| 8,971,823                                  | United States | Granted     | Precoding for segment sensitive scheduling in wireless communication systems  | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.212V880-2010   |
| 8,565,194                                  | United States | Granted     | Puncturing signaling channel for a wireless communication system  | ATIS.3GPP.36.212V880-2010                                 |
| 13/955,980                                 | United States | Application | Puncturing signaling channel for a wireless communication system  | ATIS.3GPP.36.212V880-2010                                 |
| 9,130,810                                  | United States | Granted     | OFDM communications methods and apparatus   | ATIS.3GPP.36.213V880-2010                                 |
| 9,426,013                                  | United States | Granted     | OFDM communications methods and apparatus   | ATIS.3GPP.36.213V880-2010                                 |
| 6,785,256                                  | United States | Granted     | Method for extending mobile IP and AAA to enable integrated support for local access and roaming access connectivity          | ATIS.3GPP.24.302V1270-2016                                |
| 8,179,840                                  | United States | Granted     | Method for extending mobile IP and AAA to enable integrated support for local access and roaming access connectivity          | ATIS.3GPP.24.302V1270-2016                                |
| 7,525,937                                  | United States | Granted     | Method for extending mobile IP and AAA to enable integrated support for local access and roaming access connectivity          | ATIS.3GPP.24.302V1270-2016                                |
| 7,398,111                                  | United States | Granted     | Methods and apparatus for operating mobile nodes in multiple states   | ATIS.3GPP.36.321V10100-2015                               |
| 6,961,595                                  | United States | Granted     | Methods and apparatus for operating mobile nodes in multiple states   | ATIS.3GPP.36.321V10100-2015                               |
| 7,610,024                                  | United States | Granted     | Methods and apparatus of providing transmit and/or receive diversity with multiple antennas in wireless communication systems | ATIS.3GPP.36.211V890-2010                                 |
| 7,039,370                                  | United States | Granted     | Methods and apparatus of providing transmit and/or receive diversity with multiple antennas in wireless communication systems | ATIS.3GPP.36.211V890-2010                                 |
| 8,571,493                                  | United States | Granted     | Methods and apparatus of providing transmit and/or receive diversity with multiple antennas in wireless communication systems | ATIS.3GPP.36.211V890-2010                                 |
| 9,485,761                                  | United States | Granted     | Method and apparatus for sending data and control information in a wireless communication system                              | ATIS.3GPP.36.300V8120-2010                                |
| 8,374,161                                  | United States | Granted     | Method and apparatus for sending data and control information in a wireless communication system                              | ATIS.3GPP.36.300V8120-2010                                |
| 11/775,198                                 | United States | Application | Frequency hopping in an SC-FDMA environment   | ATIS.3GPP.36.300V8120-2010;<br>ATIS.3GPP.36.331V8210-2016 |

| Patent No. or Application No. (if pending) | Country       | Status  | Title   | Specification   |
|--|---------------|---------|---|---|
| 8,477,593                                  | United States | Granted | Method and apparatus for sending signaling for data transmission in a wireless communication system                           | ATIS.3GPP.36.213V880-2010                                 |
| 8,902,861                                  | United States | Granted | Method and apparatus for sending signaling for data transmission in a wireless communication system                           | ATIS.3GPP.36.213V880-2010                                 |
| 8,223,625                                  | United States | Granted | Acquisition in frequency division multiple access systems   | ATIS.3GPP.36.331V8210-2016                                |
| 8,599,706                                  | United States | Granted | Random access signaling transmission for system access in wireless communication  | ATIS.3GPP.36.101V1350-2017                                |
| 8,374,150                                  | United States | Granted | Re-synchronization of temporary UE IDS in a wireless communication system   | ATIS.3GPP.36.300V8120-2010                                |
| 9,161,212                                  | United States | Granted | Method and apparatus for re-synchronizing of temporary UE IDS in a wireless communication system                              | ATIS.3GPP.36.300V8120-2010                                |
| 8,599,712                                  | United States | Granted | METHOD AND APPARATUS FOR SETTING REVERSE LINK CQI REPORTING MODES IN WIRELESS COMMUNICATION SYSTEM                            | ATIS.3GPP.36.211V890-2010                                 |
| 7,924,800                                  | United States | Granted | METHOD AND APPARATUS FOR SETTING REVERSE LINK CQI REPORTING MODES IN WIRELESS COMMUNICATION SYSTEM                            | ATIS.3GPP.36.211V890-2010                                 |
| 9,125,078                                  | United States | Granted | Method and apparatus for setting reverse link CQI reporting modes in wireless communication system                            | ATIS.3GPP.36.211V890-2010                                 |
| 8,705,441                                  | United States | Granted | Joint use of multi-carrier and single-carrier multiplexing schemes for wireless communication                                 | ATIS.3GPP.36.213V10120-2015                               |
| 8,873,513                                  | United States | Granted | Methods and apparatus for transferring a mobile device from a source eNB to a target eNB                                      | ATIS.3GPP.36.300V8120-2010                                |
| 8,660,085                                  | United States | Granted | Methods and apparatus for transferring a mobile device from a source eNB to a target eNB                                      | ATIS.3GPP.36.300V8120-2010                                |
| 8,660,080                                  | United States | Granted | Mapping uplink acknowledgement resource based on downlink control channel   | ATIS.3GPP.36.300V8120-2010                                |
| 8,169,956                                  | United States | Granted | Mapping uplink acknowledgement transmission based on downlink virtual resource blocks   | ATIS.3GPP.36.300V8120-2010                                |
| 8,577,377                                  | United States | Granted | Methods and apparatus for providing a wireless expansion network  | ATIS.3GPP.36.300V1350-2017;<br>ATIS.3GPP.36.331V1330-2017 |
| 9,661,650                                  | United States | Granted | Method and apparatus for UL ACK allocation  | ATIS.3GPP.36.213V880-2010;<br>ATIS.3GPP.36.331V8210-2016  |
| 9,084,277                                  | United States | Granted | Method and apparatus for UL ACK allocation  | ATIS.3GPP.36.213V880-2010;<br>ATIS.3GPP.36.331V8210-2016  |
| 8,559,321                                  | United States | Granted | Mobile IP home agent discovery  | ATIS.3GPP.24.008V8190-2014                                |
| 9,351,145                                  | United States | Granted | Mobile IP home agent discovery  | ATIS.3GPP.24.008V8190-2014                                |
| 7,920,598                                  | United States | Granted | Scrambling methods for synchronization channels   | ATIS.3GPP.36.213V880-2010                                 |
| 8,005,091                                  | United States | Granted | APPARATUS AND METHOD OF GENERATING AND MAINTAINING HYBRID CONNECTION IDENTIFICATIONS (IDS) FOR PEER-TO-PEER WIRELESS NETWORKS | ATIS.3GPP.36.300V1240-2015                                |

| Patent No. or Application No. (if pending) | Country       | Status      | Title  | Specification   |
|--|---------------|-------------|--|---|
| 8,300,715                                  | United States | Granted     | Method and apparatus for reuse of WAN infrastructure resources in a wireless peer-to-peer (P2P) network  | ATIS.3GPP.36.213V1240-2015                                |
| 8,180,058                                  | United States | Granted     | Encryption of the scheduled uplink message in random access procedure                                    | ATIS.3GPP.36.331V8210-2016                                |
| 8,081,603                                  | United States | Granted     | Compression static and semi-static context transfer  | ATIS.3GPP.36.331V1241-2015                                |
| 8,767,739                                  | United States | Granted     | Optimizing in-order delivery of data packets during wireless communication                               | ATIS.3GPP.36.300V8120-2010                                |
| 9,609,557                                  | United States | Granted     | Optimizing in-order delivery of data packets during wireless communication                               | ATIS.3GPP.36.300V8120-2010                                |
| 9,306,795                                  | United States | Granted     | MULTIPLEXING AND TRANSMISSION OF TRAFFIC DATA AND CONTROL INFORMATION IN A WIRELESS COMMUNICATION SYSTEM | ATIS.3GPP.36.211V890-2010                                 |
| 8,467,367                                  | United States | Granted     | Multiplexing and transmission of traffic data and control information in a wireless communication system | ATIS.3GPP.36.211V890-2010                                 |
| 8,654,690                                  | United States | Granted     | Switching carriers to join a multicast session within a wireless communications network                  | ATIS.3GPP.36.300V11120-2015                               |
| 9,014,155                                  | United States | Granted     | Access point configuration schemes   | ATIS.3GPP.36.423V890-2010                                 |
| 7,860,036                                  | United States | Granted     | METHODS AND APPARATUS FOR INCLUDING MODE INFORMATION IN A FRAME FOR SYSTEM ACQUISITION                   | ATIS.3GPP.36.211V890-2010                                 |
| 8,780,767                                  | United States | Granted     | Methods and apparatus for including mode information in a frame for system acquisition                   | ATIS.3GPP.36.211V890-2010                                 |
| 8,437,312                                  | United States | Granted     | Methods for intra base station handover optimizations  | ATIS.3GPP.36.331V1241-2015                                |
| 8,284,734                                  | United States | Granted     | Methods for intra base station handover optimizations  | ATIS.3GPP.36.331V1241-2015                                |
| 9,125,139                                  | United States | Granted     | Mobile access in a diverse access point network  | ATIS.3GPP.25.331V8250-2016;<br>ATIS.3GPP.36.331V8210-2016 |
| 8,588,738                                  | United States | Granted     | Mobile access in a diverse access point network  | ATIS.3GPP.25.331V8250-2016;<br>ATIS.3GPP.36.331V8210-2016 |
| 8,948,749                                  | United States | Granted     | System and method to facilitate acquisition of access point base stations                                | ATIS.3GPP.36.331V8210-2016                                |
| 9,119,132                                  | United States | Granted     | Efficient system identification schemes for communication systems  | ATIS.3GPP.36.300V8120-2010;<br>ATIS.3GPP.36.331V8210-2016 |
| 14/800,408                                 | United States | Application | Efficient system identification schemes for communication systems  | ATIS.3GPP.36.300V8120-2010;<br>ATIS.3GPP.36.331V8210-2016 |
| 8,285,281                                  | United States | Granted     | Methods and apparatus for self configuring network relations   | ATIS.3GPP.25.484V1020-2014;<br>ATIS.3GPP.36.331V8210-2016 |
| 8,600,413                                  | United States | Granted     | Control arrangement and method for communicating paging messages in a wireless communication system      | ATIS.3GPP.36.304V8100-2012                                |
| 9,131,464                                  | United States | Granted     | Control arrangement and method for communicating paging messages in a wireless communication system      | ATIS.3GPP.36.304V8100-2012                                |
| 8,639,997                                  | United States | Granted     | Buffer status report triggers in wireless communications   | ATIS.3GPP.36.300V8120-2010                                |

| Patent No. or Application No. (if pending) | Country       | Status  | Title  | Specification  |
|--|---------------|---------|--|--|
| 9,021,144                                  | United States | Granted | Buffer status report triggers in wireless communications   | ATIS.3GPP.36.300V8120-2010   |
| 8,964,653                                  | United States | Granted | Peer-to-peer device identification and cognitive communication   | ATIS.3GPP.36.213V1330-2017   |
| 14/629,378                                 | United States | Allowed | Peer-to-peer device identification and cognitive communication   | ATIS.3GPP.36.213V1330-2017   |
| 9,210,700                                  | United States | Granted | Simultaneous transmission of acknowledgement, channel quality indicator and scheduling request                                   | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.212V880-2010;<br>ATIS.3GPP.36.212V1080-2015 |
| 8,848,620                                  | United States | Granted | Simultaneous transmission of acknowledgement, channel quality indicator and scheduling request                                   | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.212V880-2010;<br>ATIS.3GPP.36.212V1080-2015 |
| 8,781,425                                  | United States | Granted | Methods and apparatus for handling a signaling message that relates to transmission rate restrictions                            | ATIS.3GPP.25.331V8250-2016   |
| 8,145,164                                  | United States | Granted | METHODS AND APPARATUS FOR HANDLING A SIGNALING MESSAGE THE RELATES TO TRANSMISSION RATE RESTRICTIONS                             | ATIS.3GPP.25.331V8250-2016   |
| 9,215,731                                  | United States | Granted | METHOD AND APPARATUS FOR TRANSFER OF A MESSAGE ON A COMMON CONTROL CHANNEL FOR RANDOM ACCESS IN A WIRELESS COMMUNICATION NETWORK | ATIS.3GPP.36.300V8120-2010;<br>ATIS.3GPP.36.323V860-2010                               |
| 8,149,773                                  | United States | Granted | Resource allocation for enhanced uplink using an acquisition indicator channel   | ATIS.3GPP.25.214V8130-2014   |
| 8,605,675                                  | United States | Granted | Resource allocation for enhanced uplink using an acquisition indicator channel   | ATIS.3GPP.25.214V8130-2014   |
| 8,472,967                                  | United States | Granted | Allocating transmit power among two or more carriers assigned to a wireless communication device                                 | ATIS.3GPP.25.321V9100-2014   |
| 8,787,181                                  | United States | Granted | Resource allocation randomization  | ATIS.3GPP.36.213V880-2010  |
| 9,036,564                                  | United States | Granted | Dynamic assignment of ACK resource in a wireless communication system  | ATIS.3GPP.36.321V8120-2014   |
| 9,439,212                                  | United States | Granted | Dynamic assignment of ACK resource in a wireless communication system  | ATIS.3GPP.36.321V8120-2014   |
| 8,711,785                                  | United States | Granted | Fast carrier allocation in multi-carrier systems   | ATIS.3GPP.36.331V10150-2015  |
| 8,665,804                                  | United States | Granted | Filtering semi-persistent scheduling false alarms  | ATIS.3GPP.36.212V1151-2015   |
| 8,165,026                                  | United States | Granted | Method and apparatus to report and manage cells in a multi carrier system  | ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V10120-2015                             |
| 9,363,745                                  | United States | Granted | Device managed access point lists in wireless communications   | ATIS.3GPP.36.304V9110-2014   |
| 8,477,734                                  | United States | Granted | Reporting of ACK and CQI information in a wireless communication system  | ATIS.3GPP.25.213V850-2010;<br>ATIS.3GPP.25.308V8111-2014                               |
| 9,735,928                                  | United States | Granted | Scrambling and modulation to constrain the constellation size of ACK/NAK transmission on the data channel                        | ATIS.3GPP.36.213V10120-2015;<br>ATIS.3GPP.36.321V8120-2014                             |



| Patent No. or Application No. (if pending) | Country       | Status      | Title   | Specification  |
|--|---------------|-------------|---|--|
| 8,737,517                                  | United States | Granted     | Scrambling and modulation to constrain the constellation size of ACK/NAK transmission on the data channel | ATIS.3GPP.36.213V10120-2015;<br>ATIS.3GPP.36.321V8120-2014   |
| 9,107,239                                  | United States | Granted     | Systems and methods to define control channels using reserved resource blocks                             | ATIS.3GPP.36.213V1190-2015;<br>ATIS.3GPP.36.331V1130-2013  |
| 14/789,332                                 | United States | Application | Systems and methods to define control channels using reserved resource blocks                             | ATIS.3GPP.36.213V1190-2015;<br>ATIS.3GPP.36.331V1130-2013  |
| 14/599,775                                 | United States | Application | Systems and methods to define control channels using reserved resource blocks                             | ATIS.3GPP.36.213V1190-2015;<br>ATIS.3GPP.36.331V1130-2013  |
| 9,628,223                                  | United States | Granted     | Bundling of ACK information in a wireless communication system  | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.300V8120-2010   |
| 8,634,333                                  | United States | Granted     | Bundling of ACK information in a wireless communication system  | ATIS.3GPP.36.211V890-2010;<br>ATIS.3GPP.36.300V8120-2010   |
| 8,432,939                                  | United States | Granted     | Using guard carriers for extra channels   | ATIS.3GPP.36.104V1350-2017;<br>ATIS.3GPP.36.211V1330-2017;<br>ATIS.3GPP.36.331V1330-2017                               |
| 8,559,359                                  | United States | Granted     | Information exchange mechanisms to achieve network QoS in wireless cellular systems                       | ATIS.3GPP.36.423V1242-2015   |
| 9,119,212                                  | United States | Granted     | Inter-cell interference cancellation framework  | ATIS.3GPP.36.331V1241-2015   |
| 8,687,545                                  | United States | Granted     | Anchor carrier in a multiple carrier wireless communication system  | ATIS.3GPP.36.321V10100-2015  |
| 14/985,262                                 | United States | Application | ANCHOR CARRIER IN A MULTIPLE CARRIER WIRELESS COMMUNICATION SYSTEM  | ATIS.3GPP.36.321V10100-2015  |
| 9,225,481                                  | United States | Granted     | Downlink grants in a multicarrier wireless communication system   | ATIS.3GPP.36.212V1080-2015   |
| 8,626,162                                  | United States | Granted     | Registration and access control in femto cell deployments   | ATIS.3GPP.25.367V950-2012  |
| 9,510,272                                  | United States | Granted     | Registration and access control in femto cell deployments   | ATIS.3GPP.25.367V950-2012  |
| 9,078,270                                  | United States | Granted     | Opportunistic relay scheduling in wireless communications   | ATIS.3GPP.36.216V1031-2013   |
| 8,184,599                                  | United States | Granted     | Management of UE operation in a multi-carrier communication system  | ATIS.3GPP.25.211V870-2012;<br>ATIS.3GPP.25.212V880-2016;<br>ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.36.300V10120-2015 |
| 9,014,301                                  | United States | Granted     | Dedicated reference signal  | ATIS.3GPP.36.212V1080-2015   |
| 8,078,111                                  | United States | Granted     | Methods and apparatus for using multiple frequency bands for communication                                | ATIS.3GPP.36.213V10120-2015  |
| 9,019,902                                  | United States | Granted     | Channel quality feedback in multicarrier systems  | ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.331V10150-2015  |

| Patent No. or Application No. (if pending) | Country       | Status  | Title   | Specification  |
|--|---------------|---------|---|--|
| 8,971,933                                  | United States | Granted | Method and apparatus for determining DRX cycle used for paging  | ATIS.3GPP.36.331V1330-2017   |
| 6,801,786                                  | United States | Granted | Method for the control of communication and communications system   | ATIS.3GPP.36.300V8120-2010   |
| RE41,773                                   | United States | Granted | Signalling method   | ATIS.3GPP.36.300V8120-2010   |
| 6,535,979                                  | United States | Granted | Method of ciphering data transmission, and cellular radio system  | ATIS.3GPP.36.300V1240-2015;<br>ATIS.3GPP.36.323V1220-2015;<br>ATIS.3GPP.36.331V1241-2015   |
| 7,167,447                                  | United States | Granted | Transporting QoS mapping information in a packet radio network  | ATIS.3GPP.24.008V8190-2014   |
| 8,155,005                                  | United States | Granted | TRANSPORTING QOS MAPPING INFORMATION IN A PACKET RADIO NETWORK  | ATIS.3GPP.24.008V8190-2014   |
| 7,003,290                                  | United States | Granted | Measurement reporting in a telecommunication system   | ATIS.3GPP.36.133V82310-2016;<br>ATIS.3GPP.36.214V870-2010;<br>ATIS.3GPP.36.300V8120-2010   |
| 7,499,701                                  | United States | Granted | Measurement reporting in a telecommunication system   | ATIS.3GPP.36.133V82310-2016;<br>ATIS.3GPP.36.214V870-2010;<br>ATIS.3GPP.36.300V8120-2010   |
| 7,096,021                                  | United States | Granted | Method for initiating in a terminal of a cellular network the measurement of power levels of signals and a terminal | ATIS.3GPP.36.214V870-2010  |
| 9,622,228                                  | United States | Granted | Data and control multiplexing in wireless communications  | ATIS.3GPP.36.213V1190-2015   |
| 9,705,653                                  | United States | Granted | Downlink control transmission in multicarrier operation   | ATIS.3GPP.36.213V1330-2017   |
| 9,374,131                                  | United States | Granted | Frequency hopping in a wireless communication network   | ATIS.3GPP.36.331V8210-2016   |
| 8,521,207                                  | United States | Granted | Closed-loop power control in multi-carrier high-speed uplink packet access  | ATIS.3GPP.25.319V970-2014;<br>ATIS.3GPP.36.213V10120-2015                                  |
| 8,571,550                                  | United States | Granted | Managing access control to closed subscriber groups   | ATIS.3GPP.24.008V9120-2014;<br>ATIS.3GPP.24.301V9110-2014                                  |
| 8,937,901                                  | United States | Granted | Carrier timing for wireless communications systems  | ATIS.3GPP.25.214V980-2014  |
| 9,094,991                                  | United States | Granted | Method and apparatus for supporting communication in low SNR scenario   | ATIS.3GPP.36.213V10120-2015;<br>ATIS.3GPP.36.213V1190-2015;<br>ATIS.3GPP.36.213V1330-2017  |
| 9,585,108                                  | United States | Granted | Method and apparatus for uplink power control in a multicarrier wireless communication system                       | ATIS.3GPP.36.212V1080-2015;<br>ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.331V10150-2015 |

| Patent No. or Application No. (if pending) | Country       | Status      | Title  | Specification  |
|--|---------------|-------------|--|--|
| 15/444,210                                 | United States | Allowed     | METHOD AND APPARATUS FOR UPLINK POWER CONTROL IN A MULTICARRIER WIRELESS COMMUNICATION SYSTEM    | ATIS.3GPP.36.212V1080-2015;<br>ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.331V10150-2015 |
| 8,599,771                                  | United States | Granted     | Control of radio links in a multiple carrier system  | ATIS.3GPP.25.214V980-2014;<br>ATIS.3GPP.36.133V82310-2016                                  |
| 9,236,985                                  | United States | Granted     | Method and apparatus for control and data multiplexing in a MIMO communication system            | ATIS.3GPP.36.211V1070-2013;<br>ATIS.3GPP.36.213V10120-2015;<br>ATIS.3GPP.36.300V10120-2015 |
| 9,119,133                                  | United States | Granted     | Local internet protocol access capability indication   | ATIS.3GPP.24.301V10150-2016  |
| 9,225,495                                  | United States | Granted     | DATA TRANSMISSION WITH CROSS-SUBFRAME CONTROL IN A WIRELESS NETWORK                              | ATIS.3GPP.36.212V1330-2017;<br>ATIS.3GPP.36.213V1330-2017                                  |
| 9,565,011                                  | United States | Granted     | Data transmission with cross-subframe control in a wireless network                              | ATIS.3GPP.36.212V1330-2017;<br>ATIS.3GPP.36.213V1330-2017                                  |
| 9,209,933                                  | United States | Granted     | METHOD AND APPARATUS FOR DISPATCHING A CHANNEL QUALITY INDICATOR FEEDBACK IN MULTICARRIER SYSTEM | ATIS.3GPP.36.300V10120-2015  |
| 14/960,067                                 | United States | Application | METHOD AND APPARATUS FOR DISPATCHING A CHANNEL QUALITY INDICATOR FEEDBACK IN MULTICARRIER SYSTEM | ATIS.3GPP.36.300V10120-2015  |
| 09106378.0                                 | United States | Granted     | Systems, apparatus and methods for communicating downlink information                            | ATIS.3GPP.36.211V1330-2017;<br>ATIS.3GPP.36.213V1330-2017                                  |
| 8,634,313                                  | United States | Granted     | Method and apparatus that facilitates a timing alignment in a multicarrier system                | ATIS.3GPP.36.133V11110-2015;<br>ATIS.3GPP.36.321V1150-2015;<br>ATIS.3GPP.36.331V1130-2013  |
| 8,767,639                                  | United States | Granted     | Systems and methods for providing feedback in an enhanced uplink network                         | ATIS.3GPP.25.319V970-2014  |
| 9,065,617                                  | United States | Granted     | MIMO related signaling in wireless communication   | ATIS.3GPP.36.211V1070-2013   |
| 9,351,293                                  | United States | Granted     | Multiple carrier indication and downlink control information interaction                         | ATIS.3GPP.36.331V10150-2015  |
| 9,281,932                                  | United States | Granted     | Methods and apparatus for subframe interlacing in heterogeneous networks                         | ATIS.3GPP.36.214V1010-2011;<br>ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.423V1070-2015  |

| Patent No. or Application No. (if pending) | Country       | Status      | Title  | Specification   |
|--|---------------|-------------|--|---|
| 8,942,192                                  | United States | Granted     | Methods and apparatus for subframe interlacing in heterogeneous networks   | ATIS.3GPP.36.214V1010-2011;<br>ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.423V1070-2015 |
| 14/978,547                                 | United States | Application | Methods and apparatus for subframe interlacing in heterogeneous networks   | ATIS.3GPP.36.214V1010-2011;<br>ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.423V1070-2015 |
| 8,638,682                                  | United States | Granted     | Method and apparatus for conducting measurements when multiple carriers are supported  | ATIS.3GPP.36.133V10170-2015   |
| 9,078,164                                  | United States | Granted     | Method and apparatus for conducting measurements when multiple carriers are supported  | ATIS.3GPP.36.133V10170-2015   |
| 9,007,914                                  | United States | Granted     | Methods and apparatus for enabling rate adaptation across network configurations   | ATIS.3GPP.24.229V9190-2014  |
| 8,767,797                                  | United States | Granted     | Apparatus and method for providing HARQ feedback in a multi-carrier wireless communication system  | ATIS.3GPP.25.308V1060-2014  |
| 9,055,576                                  | United States | Granted     | Uplink resource allocation for LTE advanced  | ATIS.3GPP.36.213V10120-2015   |
| 8,934,331                                  | United States | Granted     | Circuit switched fallback procedure  | ATIS.3GPP.36.413V9100-2016  |
| 8,571,122                                  | United States | Granted     | Method and apparatus for multiplexing data and control information in wireless communication systems based on frequency division multiple access | ATIS.3GPP.36.212V880-2010   |
| 7,613,245                                  | United States | Granted     | Method and apparatus for multiplexing data and control information in wireless communication systems based on frequency division multiple access | ATIS.3GPP.36.212V880-2010   |
| 7,929,590                                  | United States | Granted     | Method and apparatus for multiplexing data and control information in wireless communication systems based on frequency division multiple access | ATIS.3GPP.36.212V880-2010   |
| 7,697,631                                  | United States | Granted     | Method and apparatus for multiplexing data and control information in wireless communication systems based on frequency division multiple access | ATIS.3GPP.36.212V880-2010   |
| 8,848,520                                  | United States | Granted     | Aperiodic sounding reference signal transmission method and apparatus  | ATIS.3GPP.36.212V1080-2015  |
| 8,477,672                                  | United States | Granted     | 4C-HSDPA acknowledgment signaling  | ATIS.3GPP.25.213V1000-2012  |
| 9,225,413                                  | United States | Granted     | Methods and systems for uplink transmit diversity  | ATIS.3GPP.36.211V1070-2013  |
| 14/970,478                                 | United States | Allowed     | Methods and systems for uplink transmit diversity  | ATIS.3GPP.36.211V1070-2013  |
| 9,083,501                                  | United States | Granted     | Feedback of control information for multiple carriers  | ATIS.3GPP.36.213V10120-2015   |
| 14/743,211                                 | United States | Application | Feedback of control information for multiple carriers  | ATIS.3GPP.36.213V10120-2015   |

| Patent No. or Application No. (if pending) | Country       | Status      | Title   | Specification   |
|--|---------------|-------------|---|---|
| 8,666,398                                  | United States | Granted     | Random access procedure enhancements for heterogeneous networks   | ATIS.3GPP.36.331V1330-2017  |
| 14/137,468                                 | United States | Application | Random access procedure enhancements for heterogeneous networks   | ATIS.3GPP.36.331V1330-2017  |
| 9,084,149                                  | United States | Granted     | Radio link monitoring (RLM) and reference signal received power (RSRP) measurement for heterogeneous networks | ATIS.3GPP.36.300V10120-2015   |
| 8,712,401                                  | United States | Granted     | Radio link monitoring (RLM) and reference signal received power (RSRP) measurement for heterogeneous networks | ATIS.3GPP.36.300V10120-2015   |
| 9,271,167                                  | United States | Granted     | DETERMINATION OF RADIO LINK FAILURE WITH ENHANCED INTERFERENCE COORDINATION                                   | ATIS.3GPP.36.300V10120-2015;<br>ATIS.3GPP.36.423V1070-2015  |
| 8,982,743                                  | United States | Granted     | DAI designs for FDD carrier aggregation   | ATIS.3GPP.36.212V1230-2015;<br>ATIS.3GPP.36.212V1330-2017;<br>ATIS.3GPP.36.213V1240-2015;<br>ATIS.3GPP.36.213V1330-2017 |
| 13/167,383                                 | United States | Allowed     | Control information signaling for MIMO transmissions  | ATIS.3GPP.36.212V1080-2015;<br>ATIS.3GPP.36.213V10120-2015  |
| 9,781,709                                  | United States | Granted     | Reporting of channel properties in heterogeneous networks   | ATIS.3GPP.36.300V10120-2015   |
| 9,307,431                                  | United States | Granted     | Reporting of channel properties in heterogeneous networks   | ATIS.3GPP.36.300V10120-2015   |
| 8,565,205                                  | United States | Granted     | Specific absorption rate backoff in power headroom report   | ATIS.3GPP.36.101V10170-2015;<br>ATIS.3GPP.36.213V10120-2015   |
| 9,173,192                                  | United States | Granted     | Target cell selection for multimedia broadcast multicast service continuity                                   | ATIS.3GPP.36.331V1130-2013  |
| 14/838,287                                 | United States | Application | Target cell selection for multimedia broadcast multicast service continuity                                   | ATIS.3GPP.36.331V1130-2013  |
| 14/838,285                                 | United States | Application | Target cell selection for multimedia broadcast multicast service continuity                                   | ATIS.3GPP.36.331V1130-2013  |
| 14/838,209                                 | United States | Application | Target cell selection for multimedia broadcast multicast service continuity                                   | ATIS.3GPP.36.331V1130-2013  |
| 9,578,649                                  | United States | Granted     | Method and apparatus to facilitate support for multi-radio coexistence  | ATIS.3GPP.36.331V1241-2015  |
| 9,591,593                                  | United States | Granted     | Systems, methods and apparatus for radio uplink power control   | ATIS.3GPP.25.214V1210-2016  |
| 9,241,287                                  | United States | Granted     | Narrow Bandwidth Operation in LTE   | ATIS.3GPP.36.213V1330-2017  |
| 14/956,306                                 | United States | Application | Narrow Bandwidth Operation in LTE   | ATIS.3GPP.36.213V1330-2017  |
| 13/625,414                                 | United States | Application | Systems and methods for traffic detection network control   | ATIS.3GPP.24.312V1160-2014  |

| Patent No. or Application No. (if pending) | Country       | Status      | Title   | Specification   |
|--|---------------|-------------|---|---|
| 9,232,540                                  | United States | Granted     | Random access channel design for narrow bandwidth operation in a wide bandwidth system                                  | ATIS.3GPP.36.211V1330-2017;<br>ATIS.3GPP.36.213V1330-2017 |
| 9,608,899                                  | United States | Granted     | PACKET-BASED AGGREGATION OF DATA STREAMS ACROSS DISPARATE NETWORKING INTERFACES   | ATIS.3GPP.36.300V1350-2017                                |
| 13/793,587                                 | United States | Application | Methods and apparatus for uplink power control  | ATIS.3GPP.25.211V1210-2016;<br>ATIS.3GPP.25.214V1210-2016 |
| 9,635,644                                  | United States | Granted     | Downlink coverage enhancements  | ATIS.3GPP.36.306V1330-2017                                |
| 15/494,457                                 | United States | Application | DOWNLINK COVERAGE ENHANCEMENTS  | ATIS.3GPP.36.306V1330-2017                                |
| 9,232,509                                  | United States | Granted     | Apparatus and methods for improving demodulation reliability of an uplink high speed-dedicated physical control channel | ATIS.3GPP.25.214V1210-2016                                |
| 9,264,930                                  | United States | Granted     | Buffer status reporting and logical channel prioritization in multiflow operation                                       | ATIS.3GPP.36.300V1350-2017;<br>ATIS.3GPP.36.323V1331-2017 |
| 14/978,325                                 | United States | Application | Buffer status reporting and logical channel prioritization in multiflow operation                                       | ATIS.3GPP.36.300V1350-2017;<br>ATIS.3GPP.36.323V1331-2017 |
| 14/158,915                                 | United States | Application | Determining to use multi-RAN interworking by correlating different RAN identifiers                                      | ATIS.3GPP.36.463V1310-2017                                |
| 9,888,457                                  | United States | Granted     | Single-frequency network (SFN) operation for machine-type communications (MTC) coverage enhancements                    | ATIS.3GPP.36.331V1330-2017                                |
| 9,497,733                                  | United States | Granted     | Single-frequency network (SFN) operation for machine-type communications (MTC) coverage enhancements                    | ATIS.3GPP.36.331V1330-2017                                |
| 9,854,457                                  | United States | Granted     | Management of communications with multiple access points based on inter-access point communications                     | ATIS.3GPP.36.463V1310-2017                                |
| 9,420,576                                  | United States | Granted     | PDSCH transmission schemes with compact downlink control information (DCI) format in new carrier type (NCT) in LTE      | ATIS.3GPP.36.212V1330-2017                                |
| 14/254,528                                 | United States | Application | CONTROL-LESS OPERATION FOR COVERAGE LIMITED MACHINE-TYPE-COMMUNICATIONS   | ATIS.3GPP.36.213V1330-2017                                |
| 14/261,388                                 | United States | Application | X2 setup and routing at an X2-gateway   | ATIS.3GPP.36.423V1242-2015                                |
| 14/268,786                                 | United States | Application | Routing modification based on handover detection  | ATIS.3GPP.36.331V1330-2017                                |
| 9,781,628                                  | United States | Granted     | Methods and apparatus for throttling unattended applications at user devices  | ATIS.3GPP.36.331V1330-2017                                |
| 9,713,057                                  | United States | Granted     | Techniques for selected internet protocol traffic offload support at an assisting eNodeB                                | ATIS.3GPP.36.300V1350-2017                                |
| 14/905,929                                 | United States | Application | DYNAMIC INDICATION OF TIME DIVISION (TDD) DUPLEX UPLINK/DOWNLINK SUBFRAME CONFIGURATIONS                                | ATIS.3GPP.36.300V1240-2015                                |
| 14/444,824                                 | United States | Application | Uplink control information (UCI) transmission with bundling considerations  | ATIS.3GPP.36.213V1330-2017                                |
| 14/454,449                                 | United States | Application | Disjoint bearer routing   | ATIS.3GPP.36.300V1350-2017                                |
| 9,414,430                                  | United States | Granted     | Techniques for managing radio link failure recovery for a user equipment connected to a WWAN and a WLAN                 | ATIS.3GPP.36.331V1330-2017                                |

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|--|---------------|-------------|--|---|
| 14/489,122                                 | United States | Application | Base station to access point interface for data bearer routing   | ATIS.3GPP.36.300V1350-2017                                |
| 9,699,677                                  | United States | Granted     | Apparatus and methods for performing outer loop power control for frame early termination in wireless communications   | ATIS.3GPP.25.331V1240-2016                                |
| 9,674,710                                  | United States | Granted     | Channel dependent coverage enhancement techniques in LTE   | ATIS.3GPP.36.211V1330-2017                                |
| 15/495,867                                 | United States | Application | CHANNEL DEPENDENT COVERAGE ENHANCEMENT TECHNIQUES IN LTE   | ATIS.3GPP.36.211V1330-2017                                |
| 14/576,086                                 | United States | Application | SERVING GATEWAY RELOCATION AND SECONDARY NODE ELIGIBILITY FOR DUAL CONNECTIVITY  | ATIS.3GPP.36.300V1240-2015;<br>ATIS.3GPP.36.413V1340-2017 |
| 9,854,478                                  | United States | Granted     | Techniques for switching bearers between radio access technologies (RATs)  | ATIS.3GPP.36.331V1330-2017                                |
| 14/607,348                                 | United States | Application | Uplink transmit power allocation and power headroom reporting by a user equipment in a multi-connectivity environments | ATIS.3GPP.36.321V1240-2015;<br>ATIS.3GPP.36.331V1241-2015 |
| 14/602,034                                 | United States | Application | Compressed mode with DCH enhancements  | ATIS.3GPP.25.212V1210-2016                                |
| 14/569,362                                 | United States | Application | Continuous packet connectivity (CPC) with dedicated channel (DCH) enhancements   | ATIS.3GPP.25.214V1210-2016;<br>ATIS.3GPP.25.331V1240-2016 |
| 15/313,003                                 | United States | Application | PERIODIC AND APERIODIC CHANNEL STATE INFORMATION (CSI) REPORTING FOR MIMO  | ATIS.3GPP.36.213V1330-2017                                |
| 9,667,331                                  | United States | Granted     | Restricted aperiodic CSI measurement reporting in enhanced interference management and traffic adaptation              | ATIS.3GPP.36.213V1240-2015                                |
| 14/673,508                                 | United States | Application | Reporting device statistics in wireless communications   | ATIS.3GPP.36.413V1240-2015                                |
| 14/695,982                                 | United States | Application | Techniques for performing half/full-duplex operations in wireless communications                                       | ATIS.3GPP.36.211V1240-2015                                |
| 14/728,859                                 | United States | Application | Protected CET transmission and reception   | ATIS.3GPP.36.211V1330-2017                                |
| 9,743,363                                  | United States | Granted     | CCA CLEARANCE IN UNLICENSED SPECTRUM   | ATIS.3GPP.36.213V1330-2017                                |
| 15/680,017                                 | United States | Application | CCA CLEARANCE IN UNLICENSED SPECTRUM   | ATIS.3GPP.36.213V1330-2017                                |
| 9,509,486                                  | United States | Granted     | Techniques for indicating a frame format for transmissions using unlicensed radio frequency spectrum bands             | ATIS.3GPP.36.213V1330-2017                                |
| 9,763,211                                  | United States | Granted     | Open-loop timing and cyclic prefixes in cellular internet of things communication                                      | ATIS.3GPP.36.211V1330-2017                                |
| 9,510,311                                  | United States | Granted     | Open-loop timing and cyclic prefixes in cellular internet of things communication                                      | ATIS.3GPP.36.211V1330-2017                                |
| 14/825,843                                 | United States | Application | Re-synchronization management in LTE/LTE-A with unlicensed spectrum  | ATIS.3GPP.36.213V1330-2017                                |
| 9,723,651                                  | United States | Granted     | ENHANCED CONNECTION MANAGEMENT FOR MULTIPLE ACCESS NETWORKS  | ATIS.3GPP.36.300V1350-2017                                |
| 14/553,980                                 | United States | Application | Random access method of devices with different path loss   | ATIS.3GPP.36.321V1330-2017                                |
| 9,860,888                                  | United States | Granted     | UE CATEGORY HANDLING   | ATIS.3GPP.36.212V1230-2015                                |
| 14/542,470                                 | United States | Allowed     | Uplink synchronization without preamble in SC-FDMA   | ATIS.3GPP.36.211V1330-2017                                |
| 14/927,210                                 | United States | Application | NARROWBAND CONTROL CHANNEL DECODING  | ATIS.3GPP.36.211V1330-2017                                |

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|--|---------------|-------------|--|---|
| 14/950,727                                 | United States | Application | Network identification based on discovery reference signals in wireless communications                   | ATIS.3GPP.36.211V1330-2017                                |
| 14/995,437                                 | United States | Application | Uplink control information transmission using PUSCH in enhanced carrier aggregation                      | ATIS.3GPP.36.213V1330-2017                                |
| 14/995,453                                 | United States | Application | Channel state information for enhanced carrier aggregation   | ATIS.3GPP.36.213V1330-2017                                |
| 15/537,376                                 | United States | Application | SUPPORT OF TRANSMISSION MODE AND IMPACT ON PDCCH BLIND DECODES OF PTM (POINT-TO-MULTIPOINT) TRANSMISSION | ATIS.3GPP.36.213V1330-2017                                |
| 15/002,208                                 | United States | Application | Spatial and frequency diversity design for machine type communications (MTC)                             | ATIS.3GPP.36.211V1330-2017;<br>ATIS.3GPP.36.213V1330-2017 |
| 15/549,597                                 | United States | Application | DMRS ENHANCEMENT FOR HIGHER ORDER MU-MIMO  | ATIS.3GPP.36.212V1330-2017                                |
| 15/040,794                                 | United States | Application | RSRP and path loss measurements with coverage enhancements   | ATIS.3GPP.36.331V1241-2015                                |
| 15/061,092                                 | United States | Application | Selection of proximity services relay  | ATIS.3GPP.36.331V1330-2017                                |
| 15/799,908                                 | United States | Application | LOW COST PAGING  | ATIS.3GPP.36.300V1350-2017                                |
| 15/077,740                                 | United States | Allowed     | Low cost paging  | ATIS.3GPP.36.300V1350-2017                                |
| 15/080,393                                 | United States | Application | Techniques for managing communications in a shared radio frequency spectrum band                         | ATIS.3GPP.36.213V1330-2017;<br>ATIS.3GPP.36.331V1330-2017 |
| 15/132,988                                 | United States | Allowed     | Configurable random access initial power level selection   | ATIS.3GPP.36.321V1330-2017                                |
| 15/132,729                                 | United States | Application | CONTROL CHANNEL BASED BROADCAST MESSAGING  | ATIS.3GPP.36.331V1330-2017                                |
| 15/086,814                                 | United States | Application | Systems, methods, and devices for link quality based relay selection                                     | ATIS.3GPP.36.331V1330-2017                                |
| 15/563,357                                 | United States | Application | ENHANCED CSI PROCEDURES FOR FD-MIMO  | ATIS.3GPP.36.213V1330-2017                                |
| 15/152,278                                 | United States | Application | Techniques for managing communication links of a plurality of radio access technologies (RATS)           | ATIS.3GPP.36.300V1350-2017                                |
| 15/149,752                                 | United States | Allowed     | Control flow enhancements for LTE-unlicensed   | ATIS.3GPP.36.213V1330-2017;<br>ATIS.3GPP.36.300V1350-2017 |
| 15/178,253                                 | United States | Application | System information for enhanced machine type communication   | ATIS.3GPP.36.211V1330-2017                                |
| 15/183,702                                 | United States | Application | Long-term evolution compatible very narrow band design   | ATIS.3GPP.36.211V1330-2017;<br>ATIS.3GPP.36.212V1330-2017 |
| 15/181,204                                 | United States | Application | Scheduling assignment transmissions in device-to-device communications                                   | ATIS.3GPP.36.213V1240-2015                                |
| 15/197,477                                 | United States | Application | Techniques for reporting buffer status in wireless communications  | ATIS.3GPP.36.321V1240-2015                                |
| 8,767,629                                  | United States | Granted     | Method for triggering terminal to send sounding reference signal, terminal, and base station             | ATIS.3GPP.36.211V1070-2013                                |
| 9,148,879                                  | United States | Granted     | METHOD FOR TRIGGERING TERMINAL TO SEND SOUNDING REFERENCE SIGNAL, TERMINAL, AND BASE STATION             | ATIS.3GPP.36.211V1070-2013                                |
| 15/215,809                                 | United States | Application | Semi-persistent scheduling for enhanced machine type communications                                      | ATIS.3GPP.36.213V1330-2017                                |
| 15/215,148                                 | United States | Application | Configurable measurement gap and window for machine type communications                                  | ATIS.3GPP.36.306V1330-2017                                |
| 15/216,442                                 | United States | Allowed     | BUNDLE SIZE DETERMINATION FOR NARROWBAND COMMUNICATION   | ATIS.3GPP.36.213V1330-2017                                |



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|--|---------------|-------------|---|--|
| 15/232,672                                 | United States | Application | TECHNIQUES FOR HARMONIZATION BETWEEN CRS AND DM-RS BASED TRANSMISSION MODES IN UNLICENSED SPECTRUM  | ATIS.3GPP.36.211V1330-2017;<br>ATIS.3GPP.36.213V1330-2017;<br>ATIS.3GPP.36.331V1330-2017 |
| 15/244,653                                 | United States | Application | DOWNLINK AND SYNCHRONIZATION TECHNIQUES FOR NARROWBAND WIRELESS COMMUNICATIONS  | ATIS.3GPP.36.213V1330-2017   |
| 15/244,385                                 | United States | Application | Random access channel design for narrowband wireless communication  | ATIS.3GPP.36.331V1330-2017   |
| 15/245,640                                 | United States | Application | TECHNIQUES FOR ALLOCATING TIME AND FREQUENCY RESOURCES TO AN UPLINK CHANNEL TO CARRY UPLINK CONTROL INFORMATION USED FOR NARROWBAND COMMUNICATION | ATIS.3GPP.36.213V1330-2017   |
| 15/209,505                                 | United States | Application | Uplink design for narrowband LTE (NB-LTE)   | ATIS.3GPP.36.211V1330-2017   |
| 15/249,948                                 | United States | Application | COMMON SYNCHRONIZATION CHANNEL DESIGN FOR NARROWBAND COMMUNICATIONS   | ATIS.3GPP.36.331V10150-2015  |
| 15/247,355                                 | United States | Application | DESIGN OF SYNCHRONIZATION SIGNALS FOR NARROWBAND OPERATION  | ATIS.3GPP.36.211V1330-2017   |
| 15/236,947                                 | United States | Application | DRX AND SPS FOR MTC WITH BUNDLED TRANSMISSIONS  | ATIS.3GPP.36.213V1330-2017;<br>ATIS.3GPP.36.321V1330-2017                                |
| 15/255,069                                 | United States | Application | SYSTEM AND METHOD FOR NARROWBAND UPLINK SINGLE TONE TRANSMISSIONS   | ATIS.3GPP.36.211V1330-2017   |
| 15/347,382                                 | United States | Application | PHYSICAL LAYER SIGNALING TECHNIQUES IN WIRELESS COMMUNICATIONS SYSTEMS  | ATIS.3GPP.36.213V1330-2017   |
| 15/279,991                                 | United States | Application | NARROW BAND PRACH WITH MULTIPLE TONE HOPPING DISTANCES  | ATIS.3GPP.36.211V1330-2017   |
| 15/376,490                                 | United States | Application | METHODS AND APPARATUS FOR A DATA TRANSMISSION SCHEME FOR NARROW-BAND INTERNET OF THINGS (NB-IOT)  | ATIS.3GPP.36.211V1330-2017   |
| 15/341,753                                 | United States | Application | NARROW BAND PHYSICAL RANDOM ACCESS CHANNEL FREQUENCY HOPPING PATTERNS AND DETECTION SCHEMES   | ATIS.3GPP.36.211V1330-2017   |
| 15/414,250                                 | United States | Application | SRS TRANSMISSION IN MANAGEMENT IN CARRIER AGGREGATION   | ATIS.3GPP.36.213V1330-2017   |
| 15/371,885                                 | United States | Application | UPLINK DATA CHANNEL DESIGN FOR NARROWBAND DEVICES   | ATIS.3GPP.36.211V1330-2017   |
| 15/271,898                                 | United States | Application | NARROW-BAND PHYSICAL CONTROL CHANNEL DESIGN   | ATIS.3GPP.36.211V1330-2017   |
| 15/387,970                                 | United States | Application | RASTER DESIGN FOR NARROWBAND OPERATION FOR MACHINE TYPE COMMUNICATIONS  | ATIS.3GPP.36.213V1330-2017;<br>ATIS.3GPP.36.331V1330-2017                                |
| 15/272,246                                 | United States | Application | NARROW BAND ACK / NACK TRANSMISSIONS  | ATIS.3GPP.36.211V1330-2017;<br>ATIS.3GPP.36.213V1330-2017                                |
| 15/345,540                                 | United States | Application | UPLINK GRANTS FOR NARROWBAND INTERNET-OF-THINGS   | ATIS.3GPP.36.213V1330-2017   |
| 15/423,524                                 | United States | Application | ADAPTIVE RADIO LINK MONITORING  | ATIS.3GPP.36.133V1350-2017   |
| 15/428,242                                 | United States | Application | MULTI-PRB OPERATION FOR NARROWBAND SYSTEMS  | ATIS.3GPP.36.213V1330-2017;<br>ATIS.3GPP.36.331V1330-2017                                |
| 15/397,934                                 | United States | Application | PILOT DESIGN FOR UPLINK (UL) NARROW-BAND INTERNET OF THINGS (NB-IOT)  | ATIS.3GPP.36.101V1350-2017   |

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|--|---------------|-------------|--|--|
| 15/447,914                                 | United States | Application | DOWNLINK POWER ADJUSTMENT IN NARROWBAND WIRELESS COMMUNICATIONS  | ATIS.3GPP.36.213V1330-2017   |
| 15/376,025                                 | United States | Application | NARROWBAND WIRELESS COMMUNICATIONS CELL SEARCH   | ATIS.3GPP.36.211V1330-2017   |
| 15/402,927                                 | United States | Application | PERFORMING A CHANNEL STATE INFORMATION MEASUREMENT IN AN ENHANCED MACHINE-TYPE COMMUNICATION               | ATIS.3GPP.36.213V1330-2017   |
| 15/591,082                                 | United States | Application | ORDERED PHYSICAL RANDOM ACCESS CHANNEL RESOURCE MANAGEMENT   | ATIS.3GPP.36.213V1330-2017   |
| 15/593,137                                 | United States | Application | UPLINK TRANSMISSION GAPS IN EMTG   | ATIS.3GPP.36.211V1330-2017   |
| 15/646,018                                 | United States | Application | SUBFRAME VALIDITY AND SYSTEM INFORMATION RECEPTION FOR MACHINE TYPE COMMUNICATION                          | ATIS.3GPP.36.213V1330-2017   |
| 15/445,263                                 | United States | Application | PHASE ROTATION FOR IN-BAND SIGNAL GENERATION FOR NARROW BAND TRANSMISSION                                  | ATIS.3GPP.36.211V1330-2017   |
| 15/803,740                                 | United States | Application | SEARCH SPACE DESIGN FOR SEMI-PERSISTENT SCHEDULING (SPS) IN ENHANCED MACHINE-TYPE COMMUNICATIONS           | ATIS.3GPP.36.213V1330-2017   |
| 15/713,588                                 | United States | Application | RESOURCE INDEX DETERMINATION FOR BUNDLED CHANNEL TRANSMISSION IN SPECIAL SUBFRAMES                         | ATIS.3GPP.36.213V1330-2017   |
| 62/458,810                                 | United States | Application | RESOURCE INDEX DETERMINATION FOR BUNDLED CHANNEL TRANSMISSION IN SPECIAL SUBFRAMES                         | ATIS.3GPP.36.213V1330-2017   |
| 62/459,409                                 | United States | Application | TECHNIQUES AND APPARATUSES FOR NARROWBAND PHYSICAL BROADCAST CHANNEL (NB-PBCH) INTERFERENCE REDUCTION      | ATIS.3GPP.36.211V1330-2017   |
| 62/458,353                                 | United States | Application | TECHNIQUES AND APPARATUSES FOR NARROWBAND PHYSICAL BROADCAST CHANNEL (NB-PBCH) INTERFERENCE REDUCTION      | ATIS.3GPP.36.211V1330-2017   |
| 8,064,409                                  | United States | Granted     | Method and apparatus using a multi-carrier forward link in a wireless communication system                 | ATIS.3GPP.25.308V8111-2014;<br>ATIS.3GPP.25.331V8250-2016;<br>ATIS.3GPP.36.300V8120-2010 |
| 6,625,198                                  | United States | Granted     | Method and apparatus for concurrently processing multiple calls in a spread spectrum communications system | ATIS.3GPP.23.272V8120-2014;<br>ATIS.3GPP.36.331V8210-2016                                |
| 7,466,741                                  | United States | Granted     | Method and apparatus for concurrently processing multiple calls in a spread spectrum communications system | ATIS.3GPP.23.272V8120-2014;<br>ATIS.3GPP.36.331V8210-2016                                |
| 7,184,459                                  | United States | Granted     | Method and apparatus for concurrently processing multiple calls in a spread spectrum communications system | ATIS.3GPP.23.272V8120-2014;<br>ATIS.3GPP.36.331V8210-2016                                |
| 7,197,017                                  | United States | Granted     | Method and apparatus for channel optimization during point-to-point protocol (PPP) session requests        | ATIS.3GPP.24.301V8100-2012   |
| 8,363,616                                  | United States | Granted     | Method and apparatus for channel optimization during point-to-point protocol (PPP) session requests        | ATIS.3GPP.24.301V8100-2012   |
| 8,213,390                                  | United States | Granted     | Reverse link automatic repeat request  | ATIS.3GPP.36.213V880-2010  |
| 7,564,818                                  | United States | Granted     | Reverse Link Automatic Repeat Request  | ATIS.3GPP.36.213V880-2010;<br>ATIS.3GPP.36.300V8120-2010                                 |
| 8,116,283                                  | United States | Granted     | Reverse link automatic repeat request  | ATIS.3GPP.36.213V880-2010;<br>ATIS.3GPP.36.300V8120-2010                                 |

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|--|---------------|-------------|---|-----------------------------|
| 8,798,627                                  | United States | Granted     | Apparatus and method of handoff between wireless networks   | ATIS.3GPP.36.304V1330-2017  |
| 7,706,796                                  | United States | Granted     | User terminal-initiated hard handoff from a wireless local area network to a cellular network   | ATIS.3GPP.36.304V1330-2017  |
| 9,065,608                                  | United States | Granted     | METHOD OF PROVIDING A GAP INDICATION DURING A STICKY ASSIGNMENT   | ATIS.3GPP.36.213V880-2010   |
| 8,630,180                                  | United States | Granted     | Method of providing a gap indication during a sticky assignment   | ATIS.3GPP.36.213V880-2010   |
| 8,432,803                                  | United States | Granted     | Method of providing a gap indication during a sticky assignment   | ATIS.3GPP.36.213V880-2010   |
| 8,724,740                                  | United States | Granted     | Systems and methods for reducing uplink resources to provide channel performance feedback for adjustment of downlink MIMO channel data rates        | ATIS.3GPP.36.211V890-2010   |
| 9,178,584                                  | United States | Granted     | System and methods for reducing uplink resources to provide channel performance feedback for adjustment of downlink MIMO channel data rates         | ATIS.3GPP.36.211V890-2010   |
| 9,736,752                                  | United States | Granted     | Communications methods and apparatus using physical attachment point identifiers which support dual communications links                            | ATIS.3GPP.36.331V1330-2017  |
| 8,787,323                                  | United States | Granted     | Wireless communication methods and apparatus supporting synchronization   | ATIS.3GPP.36.331V1241-2015  |
| 7,778,643                                  | United States | Granted     | Power and timing control methods and apparatus  | ATIS.3GPP.36.213V880-2010;  |
| 8,099,099                                  | United States | Granted     | Methods and apparatus related to assignment in a wireless communications system   | ATIS.3GPP.36.331V8210-2016  |
| 8,982,778                                  | United States | Granted     | Packet routing in a wireless communications environment   | ATIS.3GPP.36.212V880-2010   |
| 8,369,800                                  | United States | Granted     | Methods and apparatus related to power control and/or interference management in a mixed wireless communications system                             | ATIS.3GPP.36.331V1330-2017  |
| 9,119,163                                  | United States | Granted     | Methods and apparatus related to power control and/or interference management in a mixed wireless communications system                             | ATIS.3GPP.36.213V1240-2015  |
| 8,170,572                                  | United States | Granted     | Methods and apparatus for supporting quality of service in communication systems  | ATIS.3GPP.36.331V8210-2016  |
| 7,907,970                                  | United States | Granted     | Providing quality of service for various traffic flows in a communications environment  | ATIS.3GPP.23.203V8140-2014; |
| 8,526,410                                  | United States | Granted     | Methods and apparatus related to interference management when sharing downlink bandwidth between wide area network usage and peer to peer signaling | ATIS.3GPP.36.300V8120-2010  |
| 13/956,724                                 | United States | Application | Methods and apparatus related to interference management when sharing downlink bandwidth between wide area network usage and peer to peer signaling | ATIS.3GPP.36.213V1240-2015  |
| 7,986,959                                  | United States | Granted     | Preamble based uplink power control for LTE   | ATIS.3GPP.36.321V8120-2014  |

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|--|---------------|-------------|--|--|
| 8,559,889                                  | United States | Granted     | Preamble based uplink power control for LTE  | ATIS.3GPP.36.321V8120-2014                                 |
| 9,137,755                                  | United States | Granted     | Preamble based uplink power control for LTE  | ATIS.3GPP.36.321V8120-2014                                 |
| 14/812,996                                 | United States | Allowed     | Preamble based uplink power control for LTE  | ATIS.3GPP.36.321V8120-2014                                 |
| 9,198,017                                  | United States | Granted     | Infrastructure assisted discovery in a wireless peer-to-peer network                                 | ATIS.3GPP.24.334V1211-2016                                 |
| 8,009,617                                  | United States | Granted     | Beamforming of control information in a wireless communication system                                | ATIS.3GPP.25.214V11110-2016;<br>ATIS.3GPP.36.211V1120-2013 |
| 8,848,656                                  | United States | Granted     | Utilizing broadcast signals to convey restricted association information                             | ATIS.3GPP.36.300V8120-2010                                 |
| 9,549,367                                  | United States | Granted     | Utilizing broadcast signals to convey restricted association information                             | ATIS.3GPP.36.300V8120-2010                                 |
| 9,820,240                                  | United States | Granted     | Virtual scheduling in heterogeneous networks   | ATIS.3GPP.36.213V1190-2015                                 |
| 8,971,241                                  | United States | Granted     | Techniques for supporting relay operation in wireless communication systems                          | ATIS.3GPP.36.211V1070-2013                                 |
| 9,288,747                                  | United States | Granted     | Switching wireless network selection modes in conjunction with selection of a wireless cell set      | ATIS.3GPP.36.300V9100-2014                                 |
| 6,819,937                                  | United States | Granted     | Data transmission in a TDMA system   | ATIS.3GPP.24.008V8190-2014                                 |
| 9,148,786                                  | United States | Granted     | Inclusion/exclusion messaging scheme for indicating whether a network entity performs access control | ATIS.3GPP.36.413V9100-2016                                 |
| 8,842,613                                  | United States | Granted     | POWER ALLOCATION IN MULTI-CARRIER ENHANCED UPLINK  | ATIS.3GPP.25.319V970-2014                                  |
| 8,457,056                                  | United States | Granted     | NON-SCHEDULED GRANTS IN MULTI-CARRIER ENHANCED UPLINK  | ATIS.3GPP.25.319V970-2014                                  |
| 9,560,592                                  | United States | Granted     | Method and apparatus for signaling in dense network operations                                       | ATIS.3GPP.36.211V1240-2015;<br>ATIS.3GPP.36.331V1241-2015  |
| 9,877,282                                  | United States | Granted     | Method and apparatus for signaling in dense network operations                                       | ATIS.3GPP.36.211V1240-2015;<br>ATIS.3GPP.36.331V1241-2015  |
| 9,839,027                                  | United States | Granted     | METHODS AND APPARATUS FOR MANAGING MACHINE-TYPE COMMUNICATIONS                                       | ATIS.3GPP.36.213V1330-2017                                 |
| 9,591,429                                  | United States | Granted     | METHODS AND APPARATUS FOR MANAGING MACHINE-TYPE COMMUNICATIONS                                       | ATIS.3GPP.36.213V1330-2017                                 |
| 15/450,543                                 | United States | Application | METHODS AND APPARATUS FOR MANAGING MACHINE-TYPE COMMUNICATIONS                                       | ATIS.3GPP.36.213V1330-2017                                 |
| 9,749,771                                  | United States | Granted     | METHODS AND APPARATUS FOR MANAGING MACHINE-TYPE COMMUNICATIONS                                       | ATIS.3GPP.36.211V1330-2017                                 |
| 15/620,481                                 | United States | Application | METHODS AND APPARATUS FOR MANAGING MACHINE-TYPE COMMUNICATIONS                                       | ATIS.3GPP.36.211V1330-2017                                 |
| 9,408,125                                  | United States | Granted     | AGGREGATION OF DATA BEARERS FOR CARRIER AGGREGATION  | ATIS.3GPP.36.331V1241-2015                                 |
| 15/208,499                                 | United States | Application | AGGREGATION OF DATA BEARERS FOR CARRIER AGGREGATION  | ATIS.3GPP.36.331V1241-2015                                 |
| 13/830,355                                 | United States | Application | System and method of offloading traffic to a wireless local area network                             | ATIS.3GPP.25.331V1240-2016;<br>ATIS.3GPP.36.331V1241-2015  |

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|--|---------------------------|---------------|---|-----------------------------|
| 9,473,981                                  | United States             | Granted       | Concurrent wireless communications over licensed and unlicensed spectrum  | ATIS.3GPP.36.300V1350-2017  |
| 15/257,457                                 | United States             | Application   | Concurrent wireless communications over licensed and unlicensed spectrum  | ATIS.3GPP.36.300V1350-2017  |
| 9,736,829                                  | United States             | Granted       | DOWNLINK CONTROL MANAGEMENT IN AN UNLICENSED OR SHARED SPECTRUM   | ATIS.3GPP.36.213V1330-2017  |
| 15/659,451                                 | United States             | Application   | DOWNLINK CONTROL FORMAT INDICATOR   | ATIS.3GPP.36.213V1330-2017  |
| 14/494,956                                 | United States             | Do Not Pursue | DOWNLINK CONTROL FORMAT INDICATOR   | ATIS.3GPP.36.213V1330-2017  |
| 8,224,356                                  | United States             | Granted       | Dual event slotted paging   | ATIS.3GPP.25.304V980-2014   |
| 7,983,695                                  | United States             | Granted       | Dual event slotted paging   | ATIS.3GPP.25.304V980-2014   |
| 8,046,005                                  | United States             | Granted       | Dual event slotted paging   | ATIS.3GPP.25.304V980-2014   |
| 6,832,094                                  | United States             | Granted       | Dual Event Slotted Paging   | ATIS.3GPP.25.304V980-2014   |
| 7,970,420                                  | United States             | Granted       | Dual event slotted paging   | ATIS.3GPP.25.304V980-2014   |
| 7,653,157                                  | United States             | Granted       | Method and apparatus for coordinating transmission of short messages with hard handoff searches in a wireless communications system | ATIS.3GPP.36.300V8120-2010  |
| 6,535,563                                  | United States             | Granted       | Method and apparatus for coordinating transmission of short messages with hard handoff searches in a wireless communications system | ATIS.3GPP.36.300V8120-2010  |
| 7,664,209                                  | United States             | Granted       | Method and apparatus for coordinating transmission of short messages with hard handoff searches in a wireless communications system | ATIS.3GPP.36.300V8120-2010  |
| 7,010,068                                  | United States             | Granted       | Method and Apparatus for Coordinating Transmission of Short Messages with Hard Handoff Searches in a Wireless Communications System | ATIS.3GPP.36.300V8120-2010  |
| 7,715,356                                  | United States             | Granted       | Distributed infrastructure for wireless data communications   | ATIS.3GPP.36.331V1241-2015  |
| 7,248,572                                  | United States             | Granted       | Distributed Infrastructure for Wireless Data Communications   | ATIS.3GPP.36.331V1241-2015  |
| 8,274,948                                  | United States             | Granted       | Distributed infrastructure for wireless data communications   | ATIS.3GPP.36.331V1241-2015  |
| 6,360,100                                  | United States             | Granted       | Method for Robust Handoff in Wireless Communication System  | ATIS.3GPP.36.300V11120-2015 |
| 8,588,777                                  | United States             | Granted       | Method and apparatus for robust handoff in wireless communication systems   | ATIS.3GPP.36.300V11120-2015 |
| 7,233,794                                  | United States             | Granted       | Method for Robust Handoff in Wireless Communication System  | ATIS.3GPP.36.300V11120-2015 |
| 6,256,301                                  | United States             | Granted       | Reservation Multiple Access   | ATIS.3GPP.25.331V8250-2016  |
| 6,788,937                                  | United States             | Granted       | Reservation Multiple Access   | ATIS.3GPP.25.331V8250-2016  |
| 6,987,982                                  | United States             | Granted       | Reservation Multiple Access   | ATIS.3GPP.25.331V8250-2016  |
| PCT/CN2015/090515                          | Patent Cooperation Treaty | Application   | INCREASED UPLINK PILOT TIME SLOT LENGTH IN SPECIAL SUBFRAMES  | ATIS.3GPP.36.213V1330-2017  |
| PCT/CN2016/092763                          | Patent Cooperation Treaty | Application   | Increased uplink pilot time slot length in special subframes  | ATIS.3GPP.36.213V1330-2017  |

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| PCT/CN2015/093984                          | Patent Cooperation Tr | Application | CSI feedback processing and reporting for EB/FD-MIMO   | ATIS.3GPP.36.213V1330-2017 |
| PCT/CN2016/100669                          | Patent Cooperation Tr | Application | CSI feedback processing and reporting for EB/FD-MIMO   | ATIS.3GPP.36.213V1330-2017 |
| PCT/CN2017/112144                          | Patent Cooperation Tr | Application | TECHNIQUES TO HANDLE COLLISIONS BETWEEN UPLINK TRANSMISSIONS AND DOWNLINK TRANSMISSIONS OVER A WIRELESS SPECTRUM | ATIS.3GPP.36.213V1330-2017 |
| PCT/CN2017/077275                          | Patent Cooperation Tr | Application | Techniques to handle collisions between uplink transmissions and downlink transmissions over a wireless spectrum | ATIS.3GPP.36.213V1330-2017 |